

allows that he is much embarrassed by the deviations. His arguments show a singularly clear and strong apprehension of the features of the case, and their real import. He says,⁴ "these errors of the tables are alternately in excess and defect; how could this constant compensation happen if they were casual? Moreover, the alternation from excess to defect is most rapid in the Moon, most slow in Jupiter and Saturn, in which planets the error continues sometimes for years. If the errors were casual, why should they not last as long in the Moon as in Saturn? But if we suppose the tables to be right in the mean motions, but wrong in the equations, these facts are just what must happen; since Saturn's inequalities are of long period, while those of the Moon are numerous, and rapidly changing." It would be impossible, at the present moment, to reason better on this subject; and the doctrine, that all the apparent irregularities of the celestial motions are really regular, was one of great consequence to establish at this period of the science.

Sect. 3.—Causes of the further Progress of Astronomy.

WE are now arrived at the time when theory and observation sprang forwards with emulous energy. The physical theories of Kepler, and the reasonings of other defenders of the Copernican theory, led inevitably, after some vagueness and perplexity, to a sound science of Mechanics; and this science in time gave a new face to Astronomy. But in the mean time, while mechanical mathematicians were generalizing from the astronomy already established, astronomers were accumulating new facts, which pointed the way to new theories and new generalizations. Copernicus, while he had established the permanent length of the year, had confirmed the motion of the sun's apogee, and had shown that the eccentricity of the earth's orbit, and the obliquity of the ecliptic, were gradually, though slowly, diminishing. Tycho had accumulated a store of excellent observations. These, as well as the laws of the motions of the moon and planets already explained, were materials on which the Mechanics of the Universe was afterwards to employ its most matured powers. In the mean time, the telescope had opened other new subjects of notice and speculation; not only confirming the Copernican doctrine by the phases of Venus, and the analogical examples of Jupiter and Saturn, which with their Satellites

⁴ *Astron. Kepler. Proleg. p. 17.*